



Northern Grapes News

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What are Northern Grapes?

William Shoemaker, University of Illinois

Grapes, as food and drink, have been integral to human culture for thousands of years, particularly in the Mediterranean and Middle East, so it might seem a little unusual to describe grape cultivars as “Northern Grapes.” But the work of the *Northern Grapes Project* focuses on an important new development in wine grape cultivar selection -- the emergence of new varieties of wine grapes with much greater cold-hardiness than other wine grapes. Where did these new types of grapes come from? Are they really different? Why do they deserve the attention they are getting?



photo: David L. Hansen, University of Minnesota

Peter Hemstad, grape breeder at the University of Minnesota, transfers pollen to grape flowers to complete a cross. The wine grape breeding program at the university began in 1978 and has released four cultivars to date.

History and genetics. Wine grape cultivars are historically derived from *Vitis vinifera*, the grape species native to Europe and western Asia. These cultivars, such as ‘Chardonnay’, ‘Riesling’, and ‘Merlot’, developed over thousands of years in Europe and the Middle East, becoming important elements of their economies and culture. In recent centuries they have spread globally to form important wine industries in many other regions, including mild regions of North America.

But many other species of grapes are found around the world. This is particularly true in North America, where more than 15 distinct wild species of grapes are found. The Europeans, quite familiar with grapes, took interest in these wild species

as they explored the newly-discovered continent of North America. Their interest led them to export some of these grapes back to Europe. Unfortunately, these grapes gave rise to pest problems that were inadvertently exported with the grapes. This was particularly true of grape phylloxera, an insect that feeds on grape root systems. Because European grapes are very susceptible to phylloxera, the grape industries of Europe began to decline in the 1800’s due to an epidemic. The French eventually learned to crossbreed *V. vinifera* grapes with North American wild grape species, which imparted genetic resistance to phylloxera in the resulting seedlings. In doing so, they established a model for interspecific breeding of grapes, or creating hybrid grape cultivars.

Eventually, another method was developed to address the phylloxera epidemic in Europe - using North American grape species as grafted rootstocks. However, interspecific breeding of grapes to create new wine grape cultivars continued into the middle of the 20th century in France. Many new cultivars of hybrid wine grapes were created, some of which were introduced to North America. These hybrid cultivars, such as ‘Chancellor’ and ‘Seyval Blanc’, became popular with grape growers in the eastern United States because they were more hardy and pest resistant than *vinifera* grape cultivars. Slowly, a hybrid wine grape industry began to emerge.

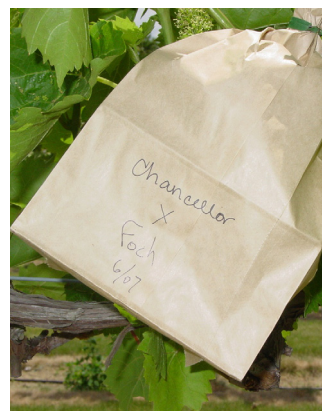


photo: Bill Shoemaker, University of Illinois

After the cross has been made, a bag is placed over the flower cluster to ensure that no other pollen lands on it. In the cross shown from the University of Illinois breeding program, ‘Chancellor’ is the female parent, and ‘Marechal Foch’ is the male parent.

A new class of super-hardy grapes emerges. Most of the French hybrids are only a little more cold-tolerant than the *V. vinifera* cultivars due to a high content of *V. vinifera*

germplasm in their background, so the spread of these cultivars into the upper Midwest and northeastern US was very limited. But the efforts of a farm worker by the name of [Elmer Swenson](#) at the University of Minnesota Arboretum revealed the potential for creating new, much harder cultivars of grapes. Elmer, with the generous support of faculty at the University of Minnesota, vigorously pursued breeding grapes suited to the environments of Minnesota and northern Wisconsin using the grapes native to that region. As he selected for high quality individuals from his breeding populations, he revealed the potential for creating super cold-hardy hybrid grape cultivars using the northern native grape species, *V. riparia*. Soon, he was joined by other private breeders and by faculty at Minnesota, and an exciting selection of new wine grape cultivars emerged.

hybrids, and the number of cold-hardy cultivars available to grape growers quickly expanded. As local wineries emerged and stimulated interest among consumers, the economic development associated with this phenomenon increased.

As a result, significant wine industries have developed in many northern regions that had no wine grape or wine industry prior to the 1970's.

Grape interspecific hybridization

Interspecific breeding of plants involves crossing plants of different species that are within the same genus. In the case of grapes, that means using multiple species within the genus *Vitis*. An historical example of an interspecific hybrid would be the [old American grape cultivar Concord](#). We know that it is a hybrid because 'Concord' grapes are perfect-flowered, a trait that is found only in *V. vinifera*, but is otherwise very much like *V. labrusca*. Hence, 'Concord' is an interspecific cross between the wild northeastern grape, *V. labrusca*, and an unknown grape that was at least in part *V. vinifera*. Other American wild grape species have the potential for contributing to interspecific crosses, which can result in the introduction of important new genetic traits into a *V. vinifera* background through interspecific hybridization.

Current activities and future potential. Grape and wine industries in the upper Midwest and northeastern United States have become important new sources of economic development at a time when the economy, particularly in rural areas, has struggled. Several Midwestern states have seen northern grape industries emerge that are valued in excess of \$100

million. Other states are quickly developing similar robust industries. Even during the current economic challenges, the industry is experiencing growth and providing a measure of stability to local rural economies.

How much potential does this industry provide? Can further breeding efforts and improved management, both in vineyards and wineries, provide further economic stimulus? These and other questions are the basis for the *Northern Grapes Project*.

For additional information:

- [University of Minnesota: Cold Hardy Grapes](#)
- [Iowa State University: A Review of Cold Climate Cultivars](#)
- [Cornell University: Wine and Juice Grape Varieties for Cool Climates](#)



photo: David Bedford, University of Minnesota

The University of Minnesota grape breeding team evaluates wines made from experimental selections in order to help determine which crosses to make and what wine optimization trials to conduct in the upcoming season. Clockwise, from bottom left are Katie Cook, Jim Luby, John Thull, Jennifer Bradley Thull, Peter Hemstad, and Nick Smith.

The potential of these new cultivars quickly attracted interest in colder regions of the northern hemisphere. These new, cold-hardy wine grape cultivars quickly spread to many northern states, Canada and northern Europe. As early adopters found success growing and making acceptable wines from these cultivars, industries began to emerge. This stimulated further interest in continuing to breed interspecific



Bill Shoemaker is a Senior Research Specialist with the University of Illinois and conducts research and outreach programs in cold climate viticulture, serving the northern half of the state out of the St. Charles Horticulture Research Center. He works with commercial grape growers in northern Illinois to address production challenges, vineyard health and fruit quality in cold climate wine grapes. A

member of the vineyard studies team, his work with the Northern Grape Project focuses on cold climate wine grape variety performance and selection.

Northern Grapes Project Launched at MGGA's Cold Climate Conference

Chrislyn Particka, Cornell University

The *Northern Grapes Project* was officially launched at the Minnesota Grape Growers Association's annual Cold Climate Conference, held February 23rd in St. Paul. The first Northern Grapes Symposium attracted 150 growers and winemakers from throughout the Midwest and Northeast for an afternoon of presentations on project goals and activities in viticulture, enology,

consumers/markets, and fruit composition and genetics by project team leaders. The afternoon symposium followed a morning team meeting with industry members of the project advisory committee.

A highlight was the "Bar Camp" sessions (pictured) following the symposium, where the audience and team members split into five groups (Economics and Marketing, Enology, Fruit Composition and Genetics, Pest Management, and Viticulture) for an open discussion of the project and to provide input on issues they face as producers and winemakers.



Following the program, Project Advisory Council member and University of Wisconsin Agricultural Extension agent Tim Rehbein commented, "The *Northern Grapes Project* is a tremendous example of the cooperation that exists between the land grant institutions and the sharing of their individual expertise in many other areas outside their state."

"Our goal was to introduce the project to a broad industry audience and plan for the upcoming first season of project activities," said project director Tim Martinson of Cornell University. "The Cold Climate Conference provided an ideal venue for doing so. The program succeeded beyond our expectations."

We sincerely thank the MGGA and program organizers Missy Machkhashvili, Terri Savaryn and MGGA president Ron Barnes for their sponsorship and joint development of the program.

We Need Your Help- Please Complete the Baseline Survey!

One of the goals of the *Northern Grapes Project* is to conduct a study of the economic impact of the industry in each of the participating states. Therefore, the economics and marketing team has developed a survey to establish a baseline for the industry in 2012, and a follow-up survey will be conducted in 2017 to measure how the industry has changed. Survey results will be shared upon completion of the study and will benefit your business directly. You will learn about the current state of the industry, identify growth patterns and changes, possess credible data on the economic impact of the industry in your state, and be able to clearly articulate the value of the industry and make more informed business decisions.

Your responses to the survey will remain confidential. Results will only be reported as totals of all responses. No individual responses will be shared or published.

If you would like to participate in this survey, please follow the links below.

Growers: www.surveymonkey.com/NorthernGrapesProjectGrowerSurvey

Wineries: www.surveymonkey.com/NorthernGrapesProjectWinerySurvey

Should you have any questions, please feel free to contact Brigid Tuck at University of Minnesota Extension. She can be reached at 507-389-6979 or tuckb@umn.edu.

Vineyard Studies: Improving Management Practices for Northern Grapes

Paul Domoto, Iowa State University



photo: Tim Martinson, Cornell University

Steve Lerch, right, research support specialist at Cornell University, discusses the proper way to prune and train grapes to the umbrella kniffin system with Phil Randazzo and Pete LaGrow of Coyote Moon Vineyards. Phil is a member of the Northern Grapes Project Advisory Council and has donated space in his vineyard for crop and canopy management studies.

The development of cold-hardy grape cultivars based on *Vitis riparia* parentage has made it possible to grow winegrapes in the upper Midwest, New England and eastern Canada where winter temperatures are too low for traditional winegrape cultivars to survive. These cold climate cultivars include four developed at the University of Minnesota, many developed by the late Elmer Swenson, and a handful developed by other private breeders and public breeding programs (see [Table 1](#) in the supplement) Because these cold climate cultivars are relatively new, we do not know under what conditions they grow best or how they can be manipulated to optimize their fruit quality and sustainability.

The climate. While the areas in which these cultivars are grown all have cold winters, the overall climate and soils are quite diverse. Within the twelve *Northern Grapes Project* cooperating states (CT, IA, IL, MA, MI, MN, ND, NE, NY, SD, VT, and WI), climatic conditions vary from less than 130 to over 180 frost-free days, less than 2,500 to over 3,500 growing degree days (base 50° F), and annual precipitation of less than 15 inches to over 50 inches. Soils are diverse in origin; the pH can vary from less than 5.5 to over 8.0 and soil organic matter content can vary from less than 1% to well over 5%. Therefore, understanding how the cultivars perform and how they respond to management practices in varying environments is important.

The challenges. In addition to improved cold hardiness, many of these *V. riparia*-based hybrids can exhibit very vigorous vegetative growth, and have been reported to have quite different fruit composition than *V. vinifera* and the more traditional interspecific French-American hybrids. For example, the red cultivars are often very high in anthocyanins and the Minnesota cultivars can attain a very high °Brix while retaining high acidity. They also tend to have characteristics such as a different profile of malic to tartaric acids, a tendency to retain more acids, a juice pH that rises rapidly during maturation, and wine that can have an “herbaceous” character, that have also been associated with grapes grown in overly-shaded canopies.

Vineyard Studies in Brief

- Evaluate the field performance of ‘Frontenac’, ‘Frontenac gris’, ‘La Crescent’, ‘Marquette’ and ‘St. Croix’ at twelve sites across the upper Midwest and Northeast in conjunction with the [NE-1020 “Multi-state evaluation of winegrape cultivars and clones” project](#).
- Determine which training systems, canopy management and cropping level strategies are the best for various cultivars in diverse climates.
- Determine the optimal mineral nutrition and soil management practices.
- Develop sustainable pest management practices and determine disease susceptibility and sensitivity to copper- and sulfur-based fungicides.

The rationale. Given the diversity of climatic and soil conditions found in the cooperating states, and the unique challenges these new cultivars present, the viticulture team (see [Table 2](#) in the supplement), is conducting studies to determine what range of fruit chemistry and maturity can be produced across the upper Midwest and Northeast and what viticultural practices can positively influence the grapes and resulting wines.



photo: Rebecca Harbut, University of Wisconsin
Mel (left) and Dave (center) Danzinger, vineyard manager and general manager of Danzinger Vineyards and Carl Duley, UW-Extension Agricultural Educator (Buffalo Co.) have a discussion in the vineyard regarding the crop load management trials that will be conducted. Danzinger Vineyards is located in Wisconsin's Mississippi Valley.

Performance across climates. The viticulture team's research is broken up into two major objectives. The first objective is to document cold climate varietal performance in variable climates and understand the resulting sensory characteristics of the fruit and wines. We will be evaluating the field performance of cold climate cultivars at twelve sites in eleven of the cooperating states (CT, IA, IL, MA, MI, ND, NE, NY, SD, VT and WI). This effort is in collaboration with the [NE-1020 project "Multi-state evaluation of winegrape cultivars and clones,"](#) and will focus on the performance of 'Frontenac', 'Frontenac gris', 'La Crescent', 'Marquette' and 'St. Croix'.

Production practices. The second objective is to develop and disseminate research-based vineyard management practices that will result in production of high quality fruit and resulting wines. The viticulture team will address whether vineyard management practices can improve the quality of fruit from cold climate cultivars and if it is economically feasible to perform the various practices. Under this objective, the viticulture team will be conducting several studies that fall under three sub-objectives -- crop and canopy management, nutrition, and pest management.

Crop and Canopy Management. The first of these sub-objectives is to evaluate crop and canopy management strategies with the goal of minimizing fruit acid content and improving fruit composition. Therefore, we will identify ideal training systems and assess different canopy and cropping level management techniques. To evaluate training systems, studies will be conducted to compare the performance of selected cold climate cultivars in five cooperating states under various systems listed in [Table 3](#) of the supplement. Studies will also be conducted to assess the influences of canopy management practices that modify the light environment (various combinations of shoot thinning, shoot positioning, summer hedging, and leaf removal) on fruit quality and wine making characteristics of 'Frontenac', 'La Crescent' and 'Marquette'. This work will be conducted in grower vineyards in Iowa and Wisconsin. Crop load adjustment studies will be conducted in grower vineyards to assess fruit quality and wine making characteristics of 'Frontenac', 'La Crescent' and 'Marquette' in Iowa, New York and North Dakota. Team members in New York will focus on the timing and severity of the crop load reduction. For each of these studies, investigators will record the time required to perform each of the practices to assess the cost-benefit relationships.



photos: Patty McManus, University of Wisconsin

The cold-hardy cultivars are thought to be particularly susceptible to anthracnose, also known Bird's-eye rot, shown on grape berries (top) and shoots (below). The plant pathologists involved on the project will characterise resistance and tolerance to anthracnose as well as other common grape diseases.

Nutrition. The second sub-objective is to determine optimal mineral nutrition and soil management practices. Unbalanced mineral nutrition due to a lack of or excessive nutrient inputs, particularly nitrogen or potassium, can lead to undesirable juice properties such as high or low acidity and sugars or low yeast assimilable nitrogen (YAN). Current mineral nutrient sufficiency ranges are based on other grape species (*V. vinifera* and *V. labrusca*) and they may not be appropriate for the new cold-hardy cultivars. There has also been recent debate on whether or not petiole sampling is the best method to assess the nutritional status of grapevines. To address these issues, the viticulture team will assess the nutrition status of grower vineyards through soil sampling and petiole and leaf blade analysis, with the tissue sampling

occurring three times during the growing season (bloom, four weeks after bloom and at veraison). This study will be conducted in four vineyards in Minnesota, four vineyards in Iowa, three vineyards in South Dakota, two vineyards in North Dakota, and one vineyard in New York. Correlations between mineral nutrient status, pruning weights, yield, and fruit quality indicators will be assessed.

Pest Management. The third sub-objective is to develop sustainable pest management recommendations based on cold-climate cultivar disease resistance and sensitivity to copper and sulfur fungicides. Host resistance is the cornerstone of sustainable disease management, but information on cold climate grape cultivars is largely based on incomplete, anecdotal reports. The Minnesota cultivars are at least moderately resistant to some diseases, but the range of resistance has not been tested. To address these issues, team members in Wisconsin and Vermont will characterize the disease and insect incidence and susceptibility of cold climate grape cultivars and correlate it to weather station data. In Wisconsin, Vermont, and New York, Patty McManus, Lorraine Berkett, and Kevin Iungerman will conduct small-scale tests to determine the sensitivity of cold climate grape cultivars to copper- and sulfur-based fungicides that are acceptable in organic vineyards.

The research the viticulture team is conducting will increase our knowledge about cold climate grapes and will lead to better recommendations for production practices under the diverse climatic and soil conditions present in the “Northern Grapes” states. The ultimate goal is to improve the quality of wine produced from cold climate grape cultivars grown in sustainable vineyards located across the upper Midwest and Northeast to support new and growing rural wineries.



Paul Domoto is a professor in the Department of Horticulture at Iowa State University. He conducts research in viticulture and pomology and is the state-wide extension specialist for all fruit crops. Paul leads the Viticulture Studies Team for the Northern Grapes Project, and will evaluate cold climate variety performance, conduct on-farm research and demonstration studies on canopy management and crop management, and collaborate on the vineyard nutrition studies.

NGP Team Profile: Katie Cook

Katie Cook has been the Enology Project Leader in the Department of Horticulture at the University of Minnesota since August 2010, after spending several years working in wineries around the world and earning a Master's degree in Enology from the Université de Bourgogne in France. As part of the Northern Grapes Project's enology team, Katie will conduct winemaking trials to optimize fermentation of cold-hardy varieties, including techniques for biological deacidification and yeast selection.



photo: David L. Hansen, University of Minnesota

1. How did you first develop an interest in wine?

I became interested in wine like most people -- through food. I found it fascinating to see how wine enhanced food and the food enhanced the wine.

2. What was your first job in the wine industry?

My first job was a “cellar rat” during the 2006 harvest at Quintessa in Rutherford (Napa Valley), California. I highly recommend that anyone wanting to work in wine production experience at least one vintage working in a wine cellar. It's a lot of hard work. You tend to work 60-80 hours a week and it's very physical work. Eighty percent of your time is spent cleaning, so you get pretty wet and cold. It's not for everyone, but I really enjoyed it - enough so to continue doing a few more vintages.

3. What drew you back to Minnesota to work in the wine industry, after working in California, Argentina, France, and Australia?

Good question. In some respects, it was easy to come back to Minnesota because it is home. I've always loved Minnesota, though as soon as I started on the wine track I thought I'd never be back in the state. Shortly after catching the wine bug I tried a few Minnesota wines. I thought they were ok, but wasn't too excited about the quality. I was fortunate enough to meet Anna Katharine Mansfield [who held Katie's position from August 2001- December 2008] while I was studying in France, and after many conversations (over many glasses of wine), she convinced me that the industry was on an upswing and could really use someone with a winemaking background to help bring it up another level. When I was home over Christmas break in 2008 I stopped over at the Horticulture Research Center and was able to try some wine made from Marquette. I also re-visited some wineries and was amazed how the quality increased in only a few short years. I was really excited about its possibility for the future here, and excited to be a part of the breeding program at the University of Minnesota. I think we've just hit the tip of the iceberg. Marquette really raised the bar in our breeding program as to what's acceptable for release to the public. Some of the newer selections are showing really good promise for the future. I think we really have a unique opportunity to create our own identity in the wine world, rather than trying to imitate what's being done elsewhere.

4. What do you like most about working with the wine industry in a research setting, compared to working as a winemaker in the industry?

I think because I had spent so much time working in the production side of the industry, I can look at research questions from a real-world approach. The cultivars that we are all familiar with -- the *Vitis vinifera* grapes like 'Merlot' and 'Chardonnay' -- have been studied for a very long time. Most of the research done to study these grapes now is interesting from a plant physiology or organic chemistry standpoint, but it doesn't have an immediate impact on the industry. The basic understanding of the grape chemistry and vine physiology is already known. Some of those basic questions haven't yet been answered for our hybrid cultivars. I like that the research we do really has an impact for winemakers. I miss working in the industry, but a research setting really allows me to try vinification techniques and methods that I would hesitate to try if I knew I needed to be able to sell the wine in the end. Something like the passito technique I used on 'Frontenac Gris' this past year had never been tried before with that variety (as far as I know). It would be scary to make 100 gallons of wine not knowing how the final product will turn out. Here, I can make one gallon, and if it turns out, great! If it doesn't, well, it's one more thing I can tell the industry not to do.

5. In your opinion, what is the most exciting research-based information that will come out of the Northern Grapes Project?

I'm really excited about some of the aroma work that will be done on. When we go through and taste through the wines made from our breeding selections, we detect aromas that are unlike what has been described in *V. vinifera*. Ann Noble's famous aroma wheel doesn't seem to have enough space to describe some of the herbaceous aromas that we find in our hybrids. They aren't necessarily bad, but just different. We already know that *V. labrusca* like 'Concord' and 'Catawba' have unique aromas that have been described as "foxy," so it's possible that some of the other native grapes also have unique aromas that haven't been formally described.



This photo from the Enology Lab at the University of Minnesota shows the aeration/oxidation method of checking free sulfur in wine. Red wine is in the "bulb" at the bottom, air is bubbled through, and it reacts with hydrogen peroxide in the top with a color indicator. The indicator changes from olive green to purple as the SO₂ concentration increases.

photo: David L. Hansen, University of Minnesota

6. What's your favorite wine?

That's a hard question! I tend to drink more red wine in the winter and white wine in the summer. My go-to red wine would be northern Rhone wines (Syrah). There are some really good value wines coming out of the Rhone Valley. If I didn't have a budget, though, I'd have to say you can't beat the elegance and finesse of a high-end red Burgundy (Pinot Noir). I also had some really good Pinot Noir out of Tasmania on a recent trip. Pinot Noir really goes well with a variety of different foods. It's one of the rare reds that can be enjoyed with fish because it's low in tannin. It's also light enough to be enjoyed on a hot day in the summer. However, on most days in the summer I'd tend to pick Riesling over any other wine. It's unfortunate that some people in the states think of Riesling as an overly-sweet white wine. Riesling is really one of the most versatile grapes, and most often in Germany it's made in a drier style. It has great acidity and freshness that makes it a refreshing wine all on its own, but it also makes it pair really well with most foods. You can find Riesling wines made in almost any style imaginable, from dry to sparkling, to off-dry, to intensely sweet ice wines. If I were to be stranded on an island and told I can only drink one wine for the rest of my life, it would have to be Riesling. Mostly because I know I'd never get bored drinking it!

The Northern Grapes Project is on Facebook!



We'll be posting updates about workshops, field days, webinars, newsletters, and more!

Do you have questions about the Northern Grapes Project, or about cold-hardy grapes and wine?

Visit our facebook page and post a question -- those of particular interest will be answered in the next issue of *Northern Grapes News*. We hope the facebook page will become an interactive community for those growing and making wine from cold-hardy grapes!

Upcoming Events

What: [Oak and Wine Barrel Workshop](#)

When: July 6-7, 2012

Where: Tassel Ridge Winery, 1681 220th St., Leighton, IA

*Registration is free, but required. Contact Tammi Martin at tkmartin@iastate.edu or 515-294-3308 to reserve your space.

What: [Viticulture Field Day](#)

When: July 25, 2012

Where: Southwest Michigan Research and Extension Center, 1791 Hillandale Road, Benton Harbor, MI

What: [Northwest Michigan Horticultural Research Center Open House](#)

When: August 23, 2012

Where: Northwest Michigan Horticulture Research Center, 6686 S. Center Hwy., Traverse City, MI

What: University of Minnesota Grape Breeding and Enology Open House

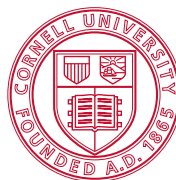
When: Sept. 8, 2012, 10am - 1pm

Where: University of Minnesota Horticultural Research Center, 600 Arboretum Drive (Minnesota Hwy 5) near Victoria, MN

What: Northern Grapes Symposium (in conjunction with Vit 2013)

When: February 6, 2013

Where: Rochester Convention Center, Rochester, NY



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